Corrugated Plastic Drain Tubing

University of Illinois at Urbana-Champaign College of Agriculture
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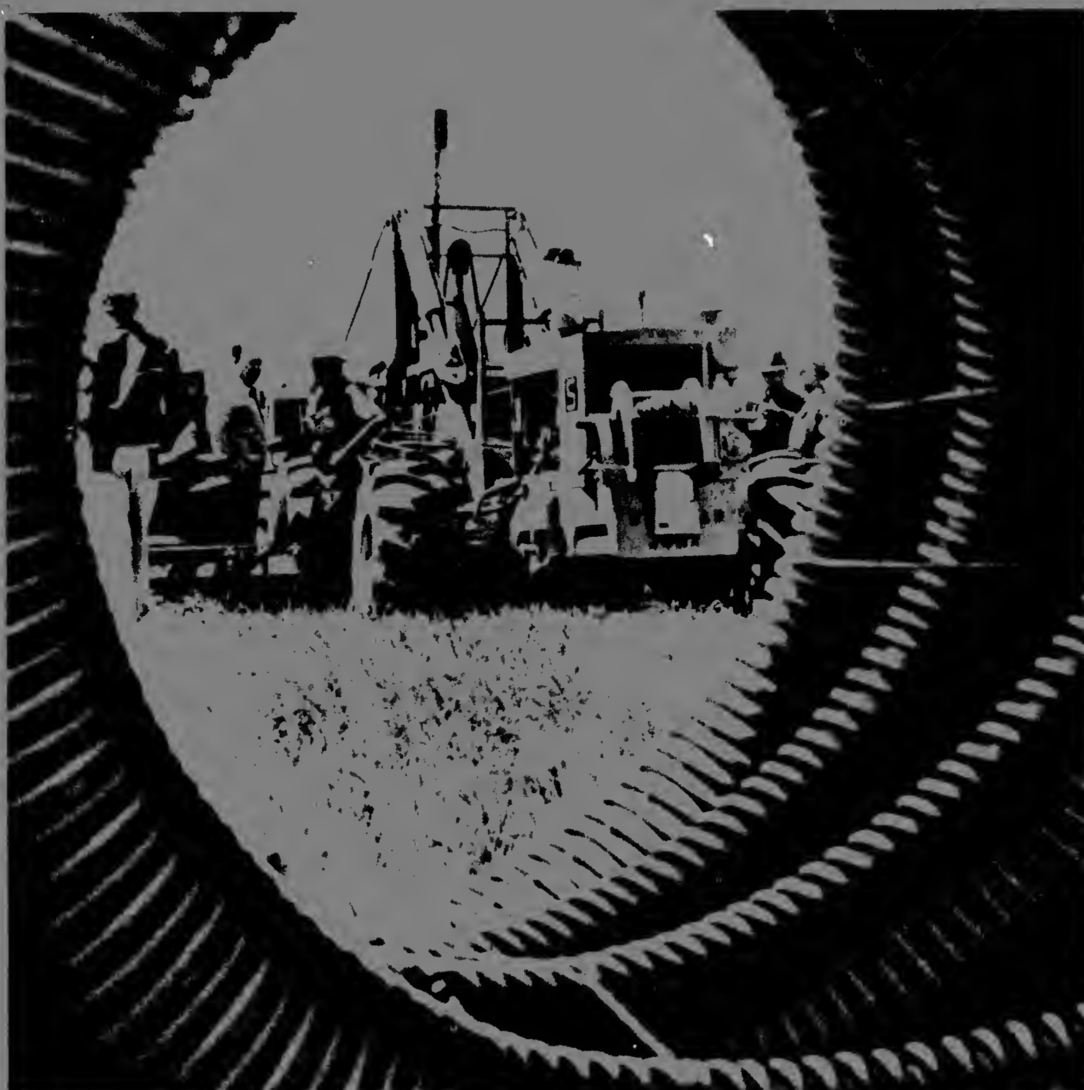

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THE USE OF CORRUGATED PLASTIC POLYETHYLENE TUBING for agricultural subsurface drainage has increased rapidly in the Midwest since 1967. Because corrugated plastic tubing is a new material for drainage, many questions have been raised concerning its use. This circular attempts to answer the questions most frequently asked by farmers, land improvement contractors, and others about corrugated plastic drain tubing. The answers may help you decide whether this tubing is suitable for your needs.

What are some advantages?

Ease of handling. The material is light, ranging in weight from 72 to 85 pounds for a 250-foot roll of 4-inch tubing. It is flexible and requires less labor for handling during installation than concrete or clay drain tile.

Better alignment in unstable soils. The long lengths of plastic tubing result in better alignment in unstable soils such as mucks, peats, and wet sands. Joint openings are eliminated.

Ease of hauling on soft fields. The light weight of plastic tubing makes it easier to distribute material on soft, wet fields.

Lower cost installation. The use of plastic tubing may result in lower total cost of drainage systems.

What are some disadvantages?

Reduced strength at high temperatures. The temperature of plastic tubing can reach 120° to 140° F. when strung out in a field on a hot, bright day. The strength of 4-inch tubing is reduced 50 percent when the temperature is raised from 70° to 120° F. For this reason, precautions must be taken to prevent the impact of sharp, heavy objects or excessive pull on the tubing during installation. The tubing regains strength when its temperature returns to that of the trench bottom. The relative strength of 4-inch tubing at various temperatures is shown in the table below.

Temperature (degrees F.)	Relative strength (percent)	Percent change from 70° F.
35	170	+70
50	139	+39
70	100	0
85	79	−21
100	62	−38
120	49	−51
140	43	−57

Reduced flexibility at low temperatures. Although the strength of the tubing increases as the temperature is decreased, flexibility decreases. If the tubing is rapidly uncoiled at low temperatures, it may be stressed excessively and crack.

Check with the manufacturer concerning his recommendation for handling the material under either hot or cold conditions.

Reduced strength by stretching. Stretch that may occur during installation will cause some decrease in strength. This stretch is influenced by the temperature of the tubing at the time it is installed, the amount and duration of drag encountered when the tubing feeds through the installation equipment, and the stretch-resistance characteristics of the tubing. In general, increased stretch is associated with low-strength tubings. Stretch should not exceed 5 percent. The relative strength of 4-inch tubing at 73° F. for various stretch lengths is shown below.

Percent stretch	Relative strength (percent)	Percent decrease from 0% stretch
0	100	0
2	95	5
4	91	9
5	89	11
6	87	13
8	83	17
10	76	24

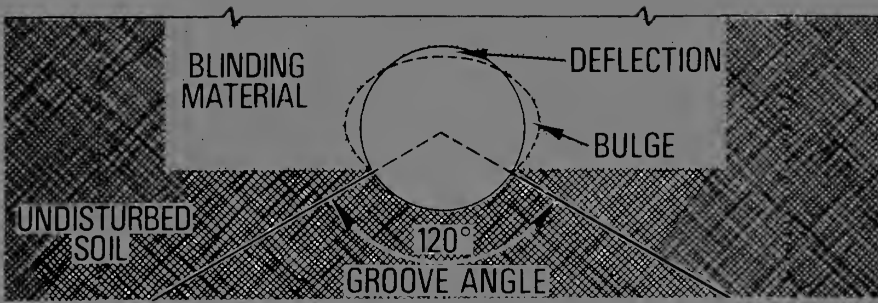
Flotation in water. Plastic tubing will float in shallow depths of water. Once the tubing floats during installation, it is difficult to get backfill material around and over the tubing without getting the material underneath it, causing misalignment. The tubing should be held in place and covered immediately when water is present.

What sizes are available?

Tubing commonly used in agricultural drainage is 4 inches in diameter or larger. The smaller sizes are available in coils of various lengths, depending on the diameter of the tubing. The larger sizes are produced in short, straight sections. Tubing smaller than 4 inches is available for special applications.

What are the strength requirements?

In contrast to rigid materials such as clay and concrete drain tile, corrugated plastic drain tubing is a flexible material. Failures occur in rigid material by cracking, and in flexible material by deflection or collapse. Flexible plastic drain tubing gains most of its soil load-carrying capacity by support from the soil at the sides of the tubing. A load on the top of the tubing causes the sidewalls to bulge outward against the soil, as shown in the figure on page 5. This soil resists the bulging, and its effect is to give flexible tubing more load-carrying ability. Plastic drain tubing must have sufficient strength to withstand the soil load without excessive deflection, collapse on the top, or failure of the sidewalls.



How do corrugations affect flow?

Research indicates that a 4-inch corrugated plastic drain can carry about 75 percent as much water as a *well-aligned* 4-inch clay or concrete drain tile on the same grade. This reduction in capacity is not significant for most lateral lines, since they seldom flow full. Four-inch laterals spaced 50 feet apart at a 0.1 percent grade seldom flow full unless they are more than 2,000 feet long. Main lines are designed for full flow, however, and the reduction in flow due to corrugations must be considered.

How does water enter the tubing?

Water enters plastic drains through small openings located in the valleys between corrugations. The flow into a plastic drain with 24 1-inch × 1/16-inch slots per foot is about the same as the flow into a tile line with a ⅛-inch gap between the tiles. Both provide about 1½ square inches of opening per foot of drain.

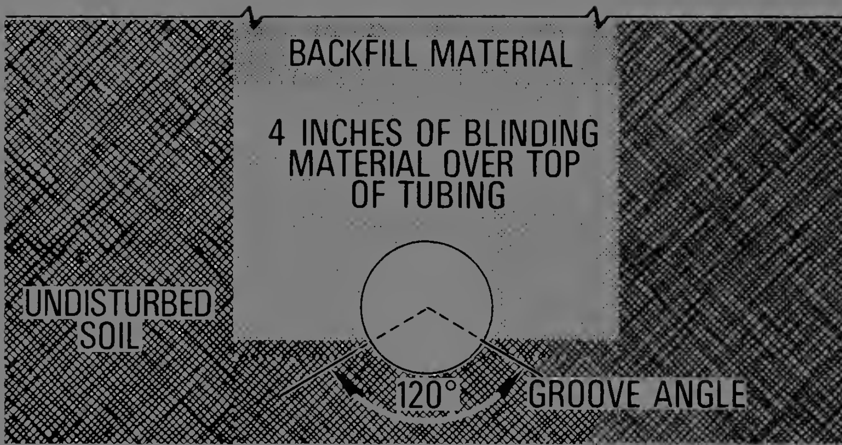
What are the recommendations for depth and spacing?

The recommendations for depth and spacing of laterals are based on the particular soils and crops involved, and are the same for both plastic and tile drains.

What special techniques are needed to install tubing?

Groove. A specially shaped groove is required in the trench bottom. This groove provides improved alignment and side support against bulging. It can be cut or formed in a number of ways. A typical groove giving 120-degree support is shown in the figure on page 6. A gravel envelope is recommended when it is impossible to form a groove.

Blinding and backfilling. Proper blinding and backfilling of plastic drain tubing are *essential*. Granular top soil for blinding around and 4 inches above the tubing is recommended to permit free water movement into the



drain. Some soil compaction on both sides of the tubing is desirable to provide good side support which will reduce bulging. For special conditions, coarse sand to fine gravel are good blinding materials.

No stones or other hard objects should be allowed in the blinding material since they apply point loads and may cause the tubing to collapse. Blinding holds the tubing in place during backfilling to insure proper alignment, and provides protection for the tubing during the backfilling operation, when the impact of rocks and hard clods could damage it. Even with good blinding, large stones or clods and heavy loads should not be dropped over the tubing.

A number of different blinding methods have proved acceptable. Some contractors place such importance on blinding that they apply selected material around and over the tubing by hand. Tubing should be held in place in the trench until secured by blinding. This operation is especially important when water is in the trench and when the air temperature is below 45° F. When the tubing feels warm (98° F.), delay backfilling until the tubing temperature reaches the soil temperature.

How can sediment and roots obstruct a drain?

The entry of sediment into the drain line is a serious problem for all subsurface drainage systems in sandy soils. When this problem exists, plastic drain tubing requires the use of the same blinding and filtering materials as clay and concrete drain tile. In fields with small pockets of sandy soils, use adequate filter materials around the tubing, or use tubing without openings in the sand pocket area. This enables the entire field to be drained, while safeguarding the life of the drain line.

Roots of trees, shrubs, and other types of vegetation growing near subsurface drains may enter them and obstruct flow. The roots enter the drains to get moisture. Masses of growing roots sometimes completely fill

the drain. When there is reason to expect this difficulty, install tubing without openings. Mechanical and hydraulic "rooters" could cause damage if used in the tubing to remove roots. As a general practice, destroy all willows and other water-loving trees within 100 feet of the drain.

How can tubing be damaged by fire and animals?

Plastic tubing can be destroyed by fire. It can also be damaged before installation by rodents. In the soil, it may be damaged by rodents when there is no rigid outlet pipe with an effective animal guard, or when the tubing is connected to old tile lines that may serve as animal runs. When the backfill is loose, or after a heavy rain, livestock may crush the tubing by stepping into the backfilled trench. For this reason, livestock should be kept out of the field until the backfill in the trenches is settled and firm.

Should plastic tubing be used for outlets to open ditches?

Although plastic tubing is available in long lengths without openings, it should not be used as an outlet pipe into an open ditch. As an exposed outlet, it can be easily damaged by trampling, rodents, fire, normal ditch maintenance procedures, and when exposed to sunlight for extended periods. A rigid pipe should be used at the outlet, with at least two-thirds of the pipe embedded in the bank to provide the required support.

How can tubing be located after installation?

Location of plastic tubing with a tile probe is more difficult than for clay or concrete tile. The probe should not be larger than a standard $\frac{3}{8}$-inch diameter rod with a $\frac{1}{2}$-inch diameter sharpened tip. The probe may penetrate the tubing when the line is found, but it will not seriously damage the tubing since the hole closes as the probe is withdrawn. If a large probe or blunt tip is used, however, there is danger of rupturing the tubing.

A map or aerial photograph should be prepared immediately after installation to identify the precise location of new lines. Old tile lines can be located with color aerial photographs if taken under appropriate conditions. Copies of this record should be carefully filed for future reference by the contractor, property owner, and system designer.

What technical assistance is available?

It will pay to hire a qualified drainage contractor to install corrugated plastic drain tubing. For additional assistance, contact your local Extension Service (county agent) or district soil conservationist.